

SEQUENCE LISTING

<110> Meakin, Susan
Volkening, Kathryn Elizabeth

<120> Method of Proliferating Precursor Cells

<130> 50217/005001

<140> US 10/591,741

<141> 2006-09-01

<150> PCT/CA05/000345

<151> 2005-03-04

<150> US 60/549,870

<151> 2004-03-04

<160> 8

<170> PatentIn version 3.3

<210> 1

<211> 492

<212> PRT

<213> Homo sapiens

<220>

<221> MISC_FEATURE

<223> FRS3 from human

<400> 1

Met	Gly	Ser	Cys	Cys	Ser	Cys	Leu	Asn	Arg	Asp	Ser	Val	Pro	Asp	Asn
1				5					10					15	

His	Pro	Thr	Lys	Phe	Lys	Val	Thr	Asn	Val	Asp	Asp	Glu	Gly	Val	Glu
			20					25					30		

Leu	Gly	Ser	Gly	Val	Met	Glu	Leu	Thr	Gln	Ser	Glu	Leu	Val	Leu	His
		35					40					45			

Leu	His	Arg	Arg	Glu	Ala	Val	Arg	Trp	Pro	Tyr	Leu	Cys	Leu	Arg	Arg
	50					55					60				

Tyr	Gly	Tyr	Asp	Ser	Asn	Leu	Phe	Ser	Phe	Glu	Ser	Gly	Arg	Arg	Cys
65					70					75					80

Gln	Thr	Gly	Gln	Gly	Ile	Phe	Ala	Phe	Lys	Cys	Ser	Arg	Ala	Glu	Glu
			85						90					95	

Ile Phe Asn Leu Leu Gln Asp Leu Met Gln Cys Asn Ser Ile Asn Val
 100 105 110

Met Glu Glu Pro Val Ile Ile Thr Arg Asn Ser His Pro Ala Glu Leu
 115 120 125

Asp Leu Pro Arg Ala Pro Gln Pro Pro Asn Ala Leu Gly Tyr Thr Val
 130 135 140

Ser Ser Phe Ser Asn Gly Cys Pro Gly Glu Gly Pro Arg Phe Ser Ala
 145 150 155 160

Pro Arg Arg Leu Ser Thr Ser Ser Leu Arg His Pro Ser Leu Gly Glu
 165 170 175

Glu Ser Thr His Ala Leu Ile Ala Pro Asp Glu Gln Ser His Thr Tyr
 180 185 190

Val Asn Thr Pro Ala Ser Glu Asp Asp His Arg Arg Gly Arg His Cys
 195 200 205

Leu Gln Pro Leu Pro Glu Gly Gln Ala Pro Phe Leu Pro Gln Ala Arg
 210 215 220

Gly Pro Asp Gln Arg Asp Pro Gln Val Phe Leu Gln Pro Gly Gln Val
 225 230 235 240

Lys Phe Val Leu Gly Pro Thr Pro Ala Arg Arg His Met Val Lys Cys
 245 250 255

Gln Gly Leu Cys Pro Ser Leu His Asp Pro Pro His His Asn Asn Asn
 260 265 270

Asn Glu Ala Pro Ser Glu Cys Pro Ala Gln Pro Lys Cys Thr Tyr Glu
 275 280 285

Asn Val Thr Gly Gly Leu Trp Arg Gly Ala Gly Trp Arg Leu Ser Pro
 290 295 300

Glu Glu Pro Gly Trp Asn Gly Leu Ala His Arg Arg Ala Ala Leu Leu
 305 310 315 320

His Tyr Glu Asn Leu Pro Pro Leu Pro Pro Val Trp Glu Ser Gln Ala
325 330 335

Gln Gln Leu Gly Gly Glu Ala Gly Asp Asp Gly Asp Ser Arg Asp Gly
340 345 350

Leu Thr Pro Ser Ser Asn Gly Phe Pro Asp Gly Glu Glu Asp Glu Thr
355 360 365

Pro Leu Gln Lys Pro Thr Ser Thr Arg Ala Ala Ile Arg Ser His Gly
370 375 380

Ser Phe Pro Val Pro Leu Thr Arg Arg Arg Gly Ser Pro Arg Val Phe
385 390 395 400

Asn Phe Asp Phe Arg Arg Pro Gly Pro Glu Pro Pro Arg Gln Leu Asn
405 410 415

Tyr Ile Gln Val Glu Leu Lys Gly Trp Gly Gly Asp Arg Pro Lys Gly
420 425 430

Pro Gln Asn Pro Ser Ser Pro Gln Ala Pro Met Pro Thr Thr His Pro
435 440 445

Ala Arg Ser Ser Asp Ser Tyr Ala Val Ile Asp Leu Lys Lys Thr Val
450 455 460

Ala Met Ser Asn Leu Gln Arg Ala Leu Pro Arg Asp Asp Gly Thr Ala
465 470 475 480

Arg Lys Thr Arg His Asn Ser Thr Asp Leu Pro Leu
485 490

<210> 2
<211> 491
<212> PRT
<213> Mus musculus

<220>
<221> MISC_FEATURE
<223> FRS3 from mouse

<400> 2

Met Gly Ser Cys Trp Ser Cys Leu Asp Arg Asp Ser Val Pro His Asn

1	5	10	15
His	Pro	Thr	Lys
	Phe	Lys	Val
	Thr	Asn	Val
	Asp	Asp	Glu
	Gly	Val	Glu
	20	25	30
Leu	Gly	Ser	Gly
	Val	Met	Glu
	Leu	Thr	Gln
	Ser	Glu	Leu
	Val	Leu	His
	35	40	45
Leu	His	Gln	Arg
	Glu	Ala	Val
	Arg	Trp	Pro
	Tyr	Leu	Cys
	Leu	Arg	Arg
	50	55	60
Tyr	Gly	Tyr	Asp
	Ser	Asn	Leu
	Phe	Ser	Phe
	Glu	Ser	Gly
	Arg	Arg	Cys
	65	70	75
Gln	Thr	Gly	Gln
	Gly	Ile	Phe
	Ala	Phe	Lys
	Cys	Ser	Arg
	Ala	Glu	Asp
	85	90	95
Ile	Phe	Asn	Leu
	Leu	Gln	Asp
	Leu	Met	Gln
	Cys	Asn	Ser
	Ile	Asn	Val
	100	105	110
Thr	Glu	Glu	Pro
	Val	Ile	Ile
	Thr	Arg	Ser
	Ser	Ser	His
	Pro	Pro	Glu
	Leu		
	115	120	125
Asp	Leu	Pro	Arg
	Gly	Pro	Pro
	Gln	Pro	Ala
	Gly	Tyr	Thr
	Val	Ser	Gly
	130	135	140
Phe	Ser	Asn	Gly
	Phe	Pro	Gly
	Cys	Pro	Gly
	Glu	Gly	Pro
	Arg	Phe	Ser
	145	150	155
Ala	Pro	Arg	Arg
	Pro	Ser	Thr
	Ser	Ser	Ser
	Leu	Arg	His
	Pro	Ser	Pro
	Gly		
	165	170	175
Glu	Glu	Ser	Thr
	His	Thr	Leu
	Ile	Ala	Ser
	Glu	Glu	Gln
	Ser	His	Thr
	180	185	190
Tyr	Val	Asn	Thr
	Pro	Thr	Gly
	Asp	Glu	Asp
	Gly	Arg	Ser
	Arg	His	Cys
	195	200	205
Leu	Gln	Pro	Leu
	Pro	Glu	Gly
	Arg	Val	Pro
	Leu	Pro	Ala
	Gln	Thr	Gln
	210	215	220
Gly	Ser	Asp	Gln
	Arg	Asp	Pro
	Gln	Val	Leu
	Leu	Gln	Pro
	Gly	Gln	Val
	225	230	235
			240

Lys Phe Val Leu Gly Pro Thr Pro Ala Arg Arg Gln Val Met Lys Cys
 245 250 255

Gln Ser Leu Cys Pro Gly Met Gln Asp Pro Pro His His Asn Asn Asn
 260 265 270

Glu Gly Pro Ser Glu Cys Pro Ala Gln Pro Lys Cys Thr Tyr Glu Asn
 275 280 285

Val Ser Gly Gly Leu Gln Gln Gly Ala Gly Trp Arg Leu Ser Pro Glu
 290 295 300

Glu Arg Gly Trp Ser Gly Leu Ala His Arg Arg Ala Ala Leu Leu His
 305 310 315 320

Tyr Glu Asn Leu Pro Pro Leu Pro Pro Val Trp Glu Ser Gln Gly Gln
 325 330 335

Gln Pro Gly Gly Glu Ala Gly Asp Asp Gly Asp Ser Arg Asp Gly Leu
 340 345 350

Thr Pro Ser Ser Asn Gly Phe Pro Asp Gly Glu Glu Asp Glu Thr Pro
 355 360 365

Leu Gln Lys Pro Thr Ser Thr Arg Ala Ser Ala Arg Ser His Ser Gly
 370 375 380

Phe Pro Val Pro Leu Thr Arg Arg Arg Gly Ser Pro Arg Val Phe Asn
 385 390 395 400

Phe Asp Phe Arg Arg Gln Gly Pro Glu Pro Pro Arg Gln Leu Asn Tyr
 405 410 415

Ile Gln Val Glu Leu Lys Gly Trp Gly Thr Ala Arg Pro Lys Gly Pro
 420 425 430

Gln Asn Pro Ser Val Ser Gly Ala Pro Gly Pro Thr Pro His Pro Val
 435 440 445

Arg Ser Ser Asp Ser Tyr Ala Val Ile Asp Leu Lys Lys Thr Ala Ala
 450 455 460

Met Ser Asp Leu Gln Arg Ala Leu Pro Arg Asp Asp Gly Ala Val Arg
 465 470 475 480

Lys Thr Arg His Asn Ser Thr Asp Leu Pro Leu
 485 490

<210> 3
 <211> 508
 <212> PRT
 <213> Homo sapiens

<220>
 <221> MISC_FEATURE
 <223> FRS2 from human

<400> 3

Met Gly Ser Cys Cys Ser Cys Pro Asp Lys Asp Thr Val Pro Asp Asn
 1 5 10 15

His Arg Asn Lys Phe Lys Val Ile Asn Val Asp Asp Asp Gly Asn Glu
 20 25 30

Leu Gly Ser Gly Ile Met Glu Leu Thr Asp Thr Glu Leu Ile Leu Tyr
 35 40 45

Thr Arg Lys Arg Asp Ser Val Lys Trp His Tyr Leu Cys Leu Arg Arg
 50 55 60

Tyr Gly Tyr Asp Ser Asn Leu Phe Ser Phe Glu Ser Gly Arg Arg Cys
 65 70 75 80

Gln Thr Gly Gln Gly Ile Phe Ala Phe Lys Cys Ala Arg Ala Glu Glu
 85 90 95

Leu Phe Asn Met Leu Gln Glu Ile Met Gln Asn Asn Ser Ile Asn Val
 100 105 110

Val Glu Glu Pro Val Val Glu Arg Asn Asn His Gln Thr Glu Leu Glu
 115 120 125

Val Pro Arg Thr Pro Arg Thr Pro Thr Thr Pro Gly Phe Ala Ala Gln
 130 135 140

Asn Leu Pro Asn Gly Tyr Pro Arg Tyr Pro Ser Phe Gly Asp Ala Ser
 145 150 155 160

Ser His Pro Ser Ser Arg His Pro Ser Val Gly Ser Ala Arg Leu Pro
 165 170 175

Ser Val Gly Glu Glu Ser Thr His Pro Leu Leu Val Ala Glu Glu Gln
 180 185 190

Val His Thr Tyr Val Asn Thr Thr Gly Val Gln Glu Glu Arg Lys Asn
 195 200 205

Arg Thr Ser Val His Val Pro Leu Glu Ala Arg Val Ser Asn Ala Glu
 210 215 220

Ser Ser Thr Pro Lys Glu Glu Pro Ser Ser Ile Glu Asp Arg Asp Pro
 225 230 235 240

Gln Ile Leu Leu Glu Pro Glu Gly Val Lys Phe Val Leu Gly Pro Thr
 245 250 255

Pro Val Gln Lys Gln Leu Met Glu Lys Glu Lys Leu Glu Gln Leu Gly
 260 265 270

Arg Asp Gln Val Ser Gly Ser Gly Ala Asn Asn Thr Glu Trp Asp Thr
 275 280 285

Gly Tyr Asp Ser Asp Glu Arg Arg Asp Ala Pro Ser Val Asn Lys Leu
 290 295 300

Val Tyr Glu Asn Ile Asn Gly Leu Ser Ile Pro Ser Ala Ser Gly Val
 305 310 315 320

Arg Arg Gly Arg Leu Thr Ser Thr Ser Thr Ser Asp Thr Gln Asn Ile
 325 330 335

Asn Asn Ser Ala Gln Arg Arg Thr Ala Leu Leu Asn Tyr Glu Asn Leu
 340 345 350

Pro Ser Leu Pro Pro Val Trp Glu Ala Arg Lys Leu Ser Arg Asp Glu
 355 360 365

Asp Asp Asn Leu Gly Pro Lys Thr Pro Ser Leu Asn Gly Tyr His Asn

370 375 380
 Asn Leu Asp Pro Met His Asn Tyr Val Asn Thr Glu Asn Val Thr Val
 385 390 395 400

 Pro Ala Ser Ala His Lys Ile Glu Tyr Ser Arg Arg Arg Asp Cys Thr
 405 410 415

 Pro Thr Val Phe Asn Phe Asp Ile Arg Arg Pro Ser Leu Glu His Arg
 420 425 430

 Gln Leu Asn Tyr Ile Gln Val Asp Leu Glu Gly Gly Ser Asp Ser Asp
 435 440 445

 Asn Pro Gln Thr Pro Lys Thr Pro Thr Thr Pro Leu Pro Gln Thr Pro
 450 455 460

 Thr Arg Arg Thr Glu Leu Tyr Ala Val Ile Asp Ile Glu Arg Thr Ala
 465 470 475 480

 Ala Met Ser Asn Leu Gln Lys Ala Leu Pro Arg Asp Asp Gly Thr Ser
 485 490 495

 Arg Lys Thr Arg His Asn Ser Thr Asp Leu Pro Met
 500 505

 <210> 4
 <211> 508
 <212> PRT
 <213> Mus musculus

 <220>
 <221> MISC_FEATURE
 <223> FRS2 from mouse

 <400> 4

 Met Gly Ser Cys Cys Ser Cys Pro Asp Lys Asp Thr Val Pro Asp Asn
 1 5 10 15

 His Arg Asn Lys Phe Lys Val Ile Asn Val Asp Asp Asp Gly Asn Glu
 20 25 30

 Leu Gly Ser Gly Val Met Glu Leu Thr Asp Thr Glu Leu Ile Leu Tyr
 35 40 45

Thr Arg Lys Arg Asp Ser Val Lys Trp His Tyr Leu Cys Leu Arg Arg
50 55 60

Tyr Gly Tyr Asp Ser Asn Leu Phe Ser Phe Glu Ser Gly Arg Arg Cys
65 70 75 80

Gln Thr Gly Gln Gly Ile Phe Ala Phe Lys Cys Ala Arg Ala Glu Glu
85 90 95

Leu Phe Asn Met Leu Gln Glu Ile Met Gln Asn Asn Ser Ile Asn Val
100 105 110

Val Glu Glu Pro Val Val Glu Arg Ser Ser His Gln Thr Glu Leu Glu
115 120 125

Val Pro Arg Thr Pro Arg Thr Pro Thr Thr Pro Gly Leu Gly Ala Gln
130 135 140

Asn Leu Pro Asn Gly Tyr Pro Arg Tyr Pro Ser Phe Gly Asp Ala Ser
145 150 155 160

Ser His Pro Ser Ser Arg His Pro Ser Val Gly Ser Ala Arg Leu Pro
165 170 175

Ser Val Gly Glu Glu Ser Thr His Pro Leu Leu Val Ala Glu Glu Gln
180 185 190

Val His Thr Tyr Val Asn Thr Thr Gly Val Gln Glu Glu Arg Lys Asn
195 200 205

Arg Ala Ser Val His Val Pro Pro Glu Ala Arg Val Ser Asn Ala Glu
210 215 220

Ser Asn Thr Pro Lys Glu Glu Pro Ser Asn Pro Glu Asp Arg Asp Pro
225 230 235 240

Gln Val Leu Leu Lys Pro Glu Gly Val Arg Phe Val Leu Gly Pro Thr
245 250 255

Pro Val Gln Lys Gln Leu Met Glu Lys Glu Lys Leu Glu Gln Leu Gly
260 265 270

Lys Asp Pro Val Ser Gly Ser Gly Ala Gly Asn Thr Glu Trp Asp Thr
275 280 285

Gly Tyr Asp Ser Asp Glu Arg Arg Asp Val Pro Pro Val Asn Lys Leu
290 295 300

Val Tyr Glu Asn Ile Asn Gly Leu Ser Ile Pro Ser Ala Ser Gly Val
305 310 315 320

Arg Arg Gly Arg Leu Thr Ser Thr Ser Thr Ser Asp Thr Gln Asn Ile
325 330 335

Asn Asn Ser Ala Gln Arg Arg Pro Ala Leu Leu Asn Tyr Glu Asn Leu
340 345 350

Pro Ser Leu Pro Pro Val Trp Glu Ala Arg Lys Leu Ser Arg Asp Glu
355 360 365

Asp Asp Asn Leu Gly Pro Lys Thr Pro Ser Leu Asn Gly Tyr His Asn
370 375 380

Asn Leu Asp Pro Met His Asn Tyr Val Asn Thr Glu Asn Val Thr Val
385 390 395 400

Pro Ala Ser Ala His Lys Ile Asp Tyr Ser Lys Arg Arg Asp Cys Thr
405 410 415

Pro Thr Val Phe Asn Phe Asp Ile Arg Arg Pro Ser Leu Glu His Arg
420 425 430

Gln Leu Asn Tyr Ile Gln Val Asp Leu Glu Gly Gly Ser Asp Ser Asp
435 440 445

Asn Pro Gln Thr Pro Lys Thr Pro Thr Thr Pro Leu Pro Gln Thr Pro
450 455 460

Thr Arg Arg Thr Glu Leu Tyr Ala Val Ile Asp Ile Glu Arg Thr Ala
465 470 475 480

Ala Met Ser Asn Leu Gln Lys Ala Leu Pro Arg Asp Asp Gly Thr Ser
485 490 495

Arg Lys Thr Arg His Asn Ser Thr Asp Leu Pro Met
500 505

<210> 5
<211> 18
<212> DNA
<213> artificial

<220>
<223> synthetic DNA primer

<400> 5
agccacccaa tgctctag 18

<210> 6
<211> 24
<212> DNA
<213> artificial

<220>
<223> synthetic DNA primer

<400> 6
gtgggggcag gttctcatag tgcg 24

<210> 7
<211> 24
<212> DNA
<213> artificial

<220>
<223> synthetic DNA primer

<400> 7
agccacccaa tgctctaggc taca 24

<210> 8
<211> 24
<212> DNA
<213> artificial

<220>
<223> synthetic DNA primer

<400> 8
gtgggggcag gttctcatag tgca 24